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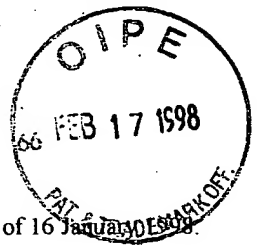


February 13, 1998
Re:
William H. Swain, inventor
Error Correction by Selective Modulation
SN 08/579,395; Filed 12/27/95; Art 2213
Patent Examiner: Mr. Russell M. Kobert
Group 2200
703-308-5222 305-4900
Primary Examiner: Mr. Ernest F. Karlsen

Subject:
Response to the Action of 16 January 1998.

#10 2/27/98
L-T.

-2/16/98 - Holiday

1) Introduction:

This response generally follows the examiner's action of 16 January 1998.

Applicant welcomes the examiner's concern for the liability Applicant assumes in choosing to prosecute his invention. The considerable cost of an attorney has also been considered. I will do my best not to strain the examiner's patience.

Toward this end I include three photos, Table I, Tables 7.1 through 9.2, and Exhibits I through V, plus VII, VIII, and IX which summarize my position. I hope it will be easily understood and readily accepted.

2) Applicant appreciates the examiner's withdrawal of the requirements of the office action of February 21, 1997. I herewith present 2 new claims; #30 and #31. Existing Claims #1, 10, 12, 26, and 28 are revised for clarity.

The response which follows makes the required Provisional election under protest.

3) Applicant does not agree with the examiner's requirement to restrict. Reconsideration is requested. My traverse follows.

I Provisionally elect invention III, species (1), Claims 17-23.

As a personal note, this is a tough choice. Claims 17-23 cover many potential applications, including our MEC (Claim 23, photo 2). But I passed up Generic Claim 14 because it is a sensor - perhaps part of an apparatus. I also passed up Claim 15 which is the broadest form of the MER (Claim 29, and photo 1) which is now in use, and well received by our customers.

3.1 Summary response to Examiner's paragraph 3.

Some of Applicant's previous Claims are now seen as indefinite as to Process of Making (PM) or Method of Use (Mu). These have been revised to make them more definite in showing that all claims, both now and before, are and were intended to be Process of Making, or Apparatus (AP).

Table I is added to clarify Applicant's position with respect to that of the Examiner's action. The left side of the page is a summary of my understanding of the Examiner's action. The right side is Applicant's statement of the genus, species, and type of each claim as now presented.

Table I

Examiner			Applicant			
Invention	Species	Type	Claim	Genus	Species	Type
1	(1)	Mu	1	14	Comb	PM
1	(1)	Mu	2	14	Comb	PM
1	(1)	Mu	3	14	Comb	PM
1	(1)	Mu	4	14.1	Comb	PM
1	(1)	Mu	5	14.1	Comb	PM
1	(1)	Mu	6	14.2	Comb	PM
1	(1)	Mu	7	14.2	Comb	PM
11	(1)	AP	8	14	Comb	AP
11	(1)	AP	9	14.1	Comb	AP
1	(2)	Mu	10	14	Comb	PM
1	(2)	Mu	11	14.1	Comb	PM
1	(3)	Mu	12	14.2	Better	PM
11	(2)	AP	13	14.2	Better	AP
11	(3)	AP	14	Genus 14	General	AP
11	(4)	AP	15	14	Better	AP
11	(5)	AP	16	14	Comb	AP
111	(1)	PM	17	14	Comb	PM
111	(1)	PM	18	14	Comb	PM
111	(1)	PM	19	14	Comb	PM
111	(1)	PM	20	14.1	Comb	PM
111	(1)	PM	21	14.1	Comb	PM
111	(1)	PM	22	14.2	Comb	PM
111	(1)	PM	23	14.2	Comb	PM
11	(5)	AP	24	14	Comb	AP
11	(5)	AP	25	14.1	Comb	AP
1	(4)	Mu	26	14	Comb	PM
1	(4)	Mu	27	14.1	Comb	PM
111	(2)	PM	28	14.2	Better	PM
11	(6)	AP	29	14.2	Better	AP
NEW			14.1 = 30 Genus	(14 Limited to Non-Contact)		
NEW			14.2 = 31 Genus	(14 Limited to Swain)		

AP = Apparatus
Mu = Method of Use
PM = Process of Making
Total number of species = 12.

Comb = Combiner Species
Better = Better SNR Species

Exhibit VIII references narrow Claim 23. This is in Genus Claim 31; species "Combiner". An embodiment is shown in photo #2.

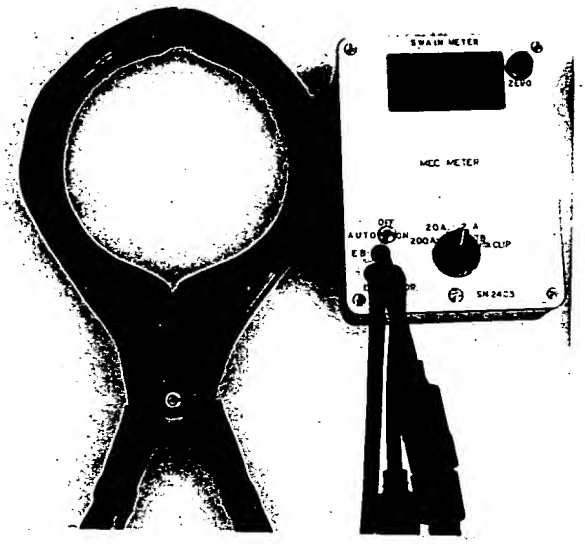


Photo #2 A MEC type Swain Meter. Genus: Claim 31

Species: Combiner

New Claim 30 (exhibit IV, page 8) is generic for a lot of claims, but not all, because it is more narrow than Claim 14. It is restricted to a current flowing in a non-contact sensor. New Claim 31 (exhibit VII, page 10) is an even more limited form of Claim 14 than Claim 30. Photo #3 is a Sensor embodying Claim 31.

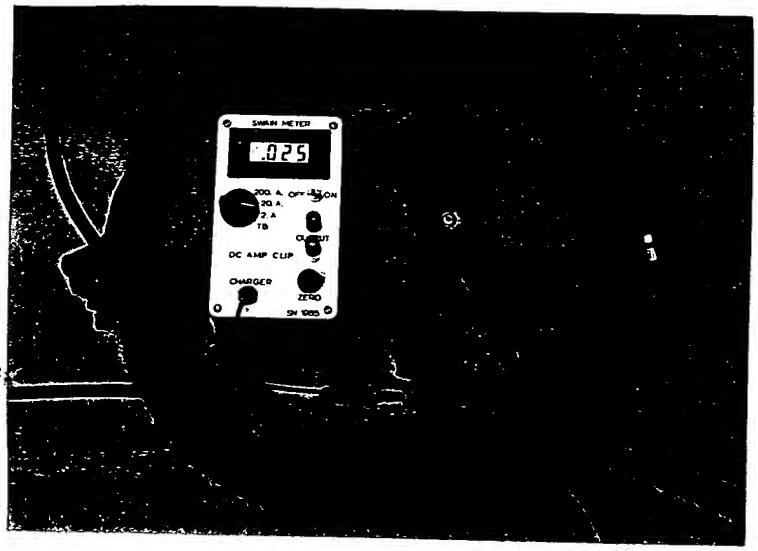


Photo #3 A Digital + type Swain Meter with ¾" or 13" Sensor.

Generic Sensor, Claim 31

Applicant sees only two Species; "Combiner" and "Better SNR". These are shown in table I, page 2. Claims 1 through 11, plus 16 through 27 are "Combiner". Therefore these Claims are linked, and need not be divided. Claims 12, 13, 15, 28, and 29 are "Better SNR". Then these Claims are linked, and need not be divided.

Both of the Species contain limitations of Generic Claim 14 and it's subs, New Claims 30 and 31. Therefore they are linked, so they need not be divided. Claim 14 (exhibit I, page 5) is broad. It is generic for all of the present 31 claims.

All claims are also linked together because each one contains limitations to the "Necessary Process", i.e., the find or manufacture a sensor to have the "Essential Characteristic". So they need not be divided; whether or not a generic claim is present and/or allowed.

Exhibits I through IX, less VI display the two species of my invention with their characteristics, genus, and claims. For example, exhibit III on page 7 is quite broad. One way of defining Species "Better SNR" is in the included phrase "...SNR is substantially improved...". The graph shows how to do it. It is used in Machine Claim 15, in Genus Claim 14. Species "Better SNR" is shown in a much more narrow form in Exhibit IX on page 12. Claim 29 is in Genus Claim 31, Species "Better SNR". The MER shown in photo #1 is an embodiment of Claim 29.

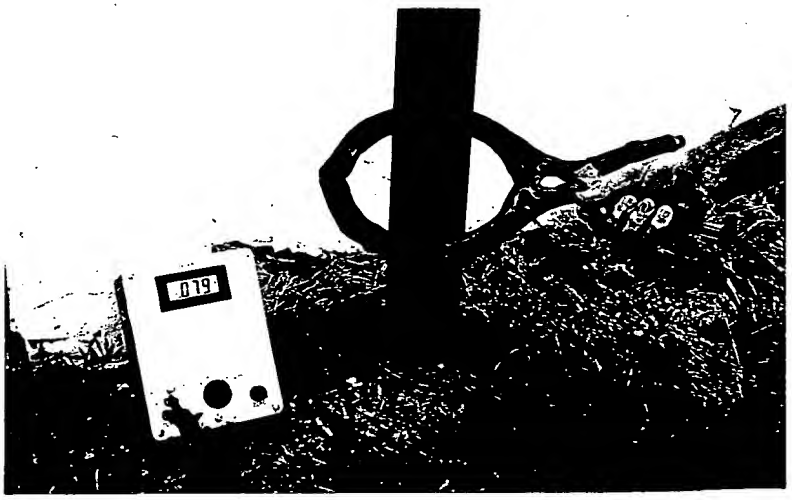


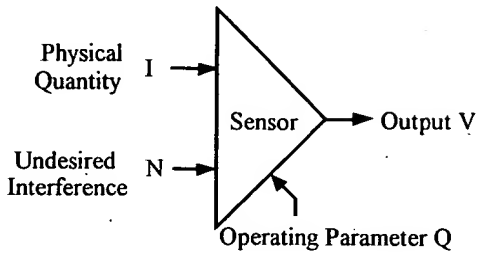
Photo #1 A MER type Swain Meter.

Genus: Claim 31

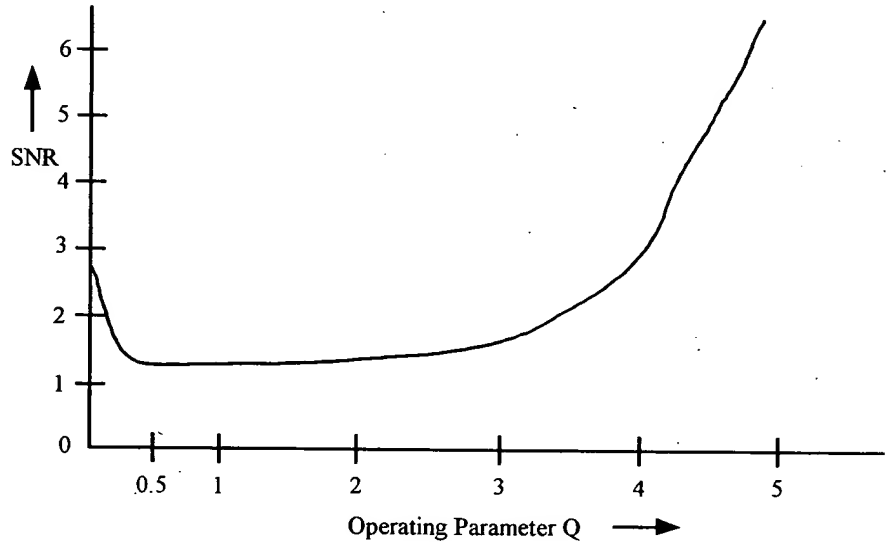
Species: Better SNR

Characteristic of Generic Sensor, Claim 14. Exhibit #I

Representation of Generic Sensor, Claim 14.



The method used is usually to find or construct a sensor which has a signal to noise ratio SNR which changes a lot when its operating parameter is selectively modulated.



Signal to Noise Ratio (SNR)
vs.
Operating Parameter Q

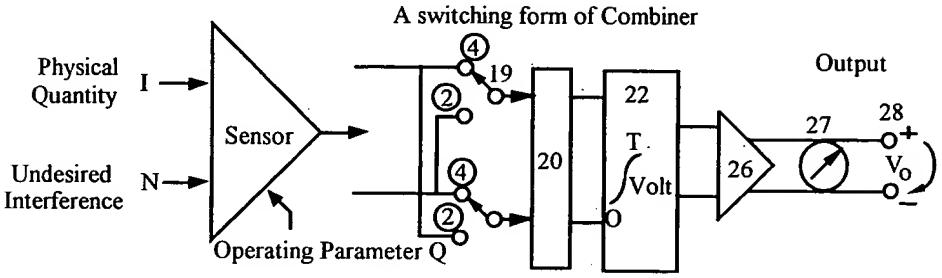
Exhibit #I

Characteristics of Combiner Species Exhibit #II

Genus: Claim 14

Species: Combiner

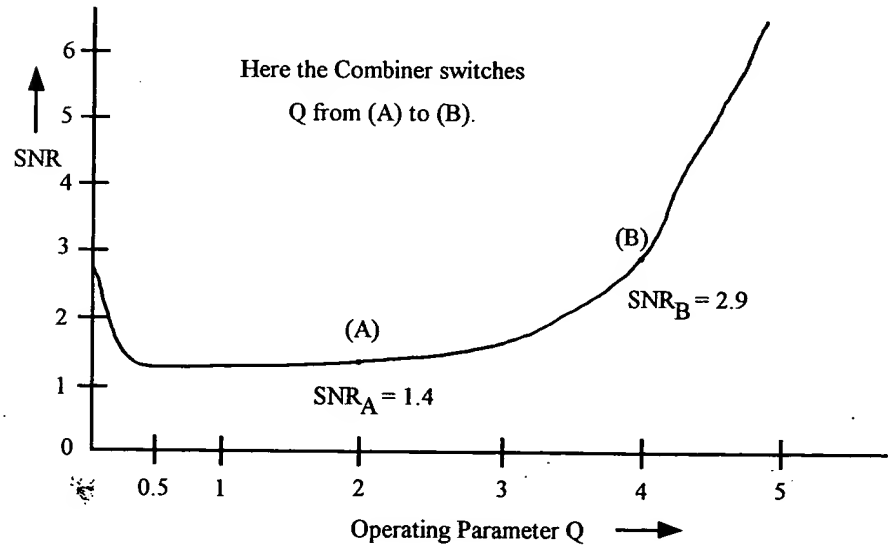
Claims:				
	1	8	17	24
	2	10	18	26
	3	16	19	



General Method

method and/or procedure for determining if the sensor has the essential characteristic, and if so, how to use selective modulation to improve accuracy by canceling error.

Eq. i) $V_c = (g_B - \frac{g_A}{\eta})I + (g_B\Psi_B - \frac{g_A\Psi_A}{\eta})N.$ This is a more basic equation i.e., a general method.



Signal to Noise Ratio (SNR)
vs.
Operating Parameter Q

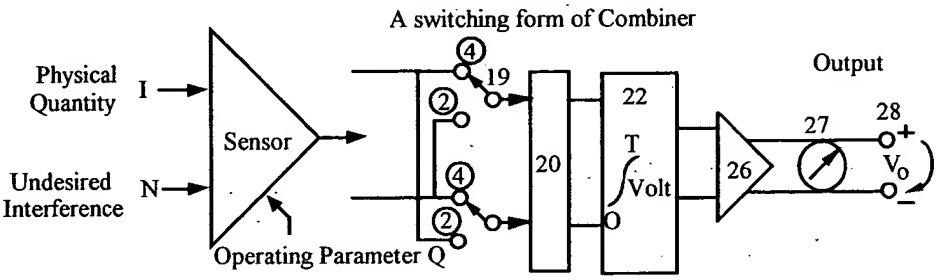
Exhibit #II

Characteristics of Combiner Species Exhibit #II

Genus: Claim 14

Species: Combiner

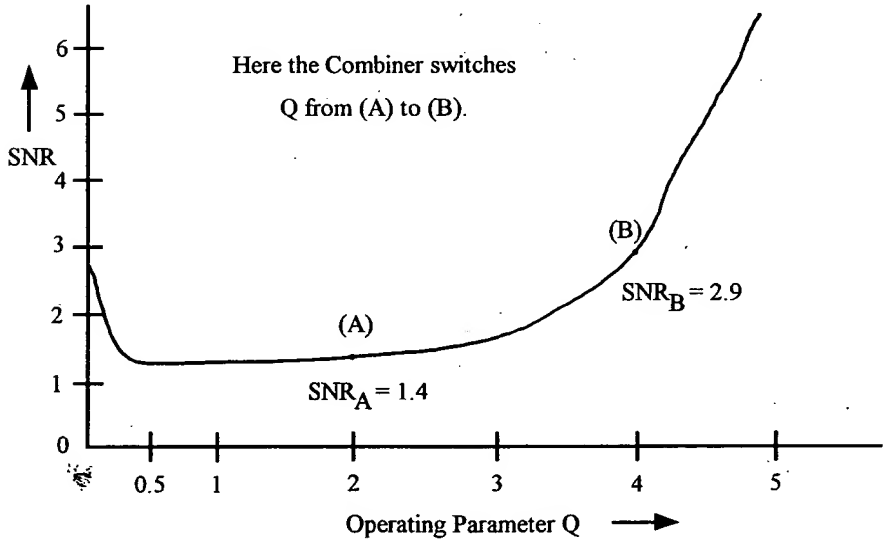
Claims:				
	1	8	17	24
	2	10	18	26
	3	16	19	



General Method

method and/or procedure for determining if the sensor has the essential characteristic, and if so, how to use selective modulation to improve accuracy by canceling error.

Eq. i) $V_c = (g_B - \frac{g_A}{\eta})I + (g_B\Psi_B - \frac{g_A\Psi_A}{\eta})N$ This is a more basic equation i.e., a general method.



Signal to Noise Ratio (SNR)
vs.
Operating Parameter Q

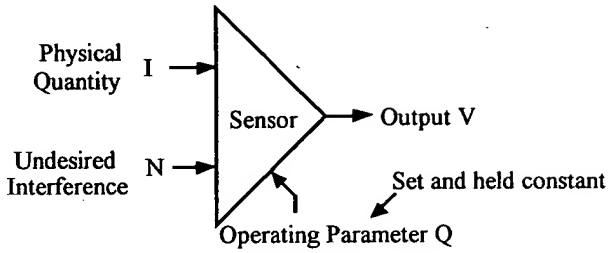
Exhibit #II

Characteristics of Better SNR Species Exhibit #III

Genus: Claim 14

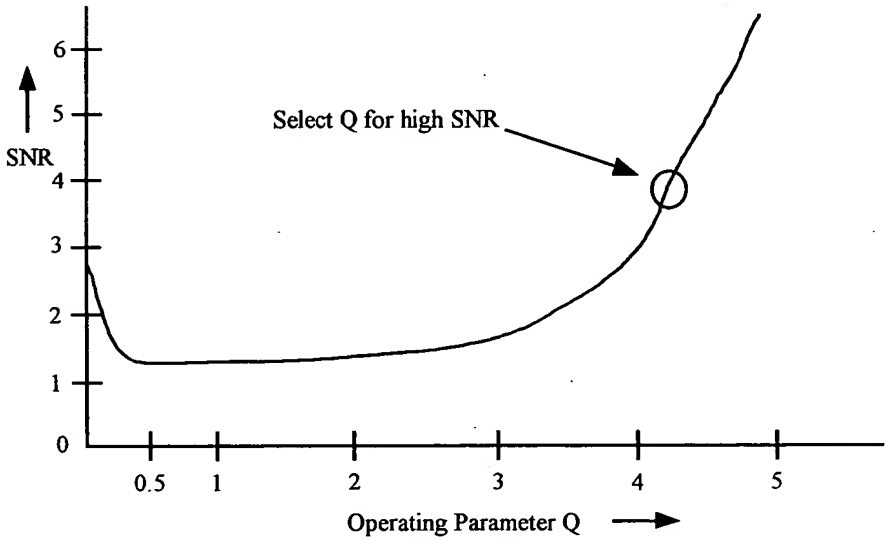
Species: Better SNR

Claims: 15



General representation of a Sensor.

In a simpler form, SNR is substantially improved by operating at a more favorable operating parameter magnitude. Noise is not canceled, but this form can be faster and cost less.

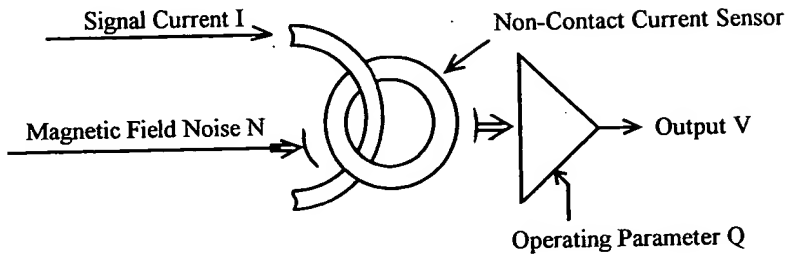


Signal to Noise Ratio (SNR)
vs.
Operating Parameter Q

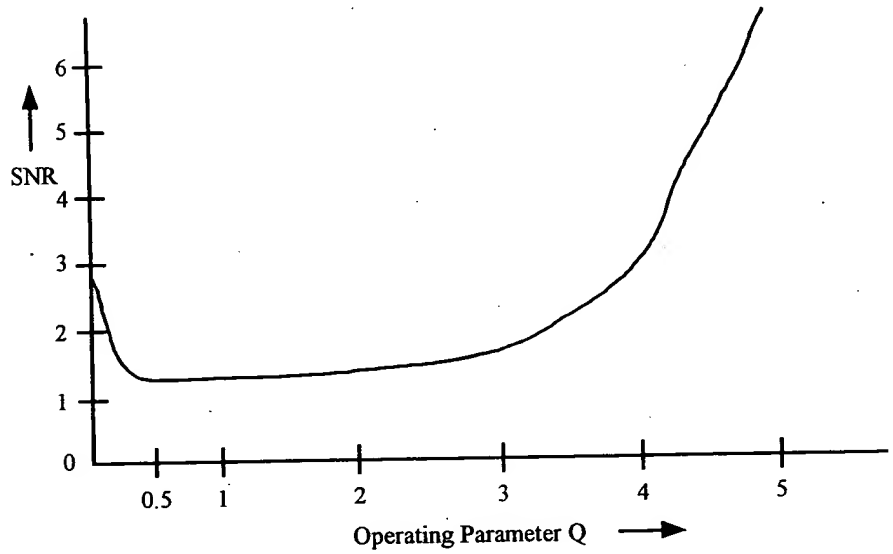
Exhibit #III

Characteristic of Generic Sensor Claim 30 (14.1) Exhibit #IV

Representation of Generic Sensor Claim 30 (14.1)



Operating Parameter Q can be thought of as an input to a modulator, or as the modulator itself. Functionally, a change in Q causes a change in the SNR of the sensor.



Signal to Noise Ratio (SNR)
vs.
Operating Parameter Q

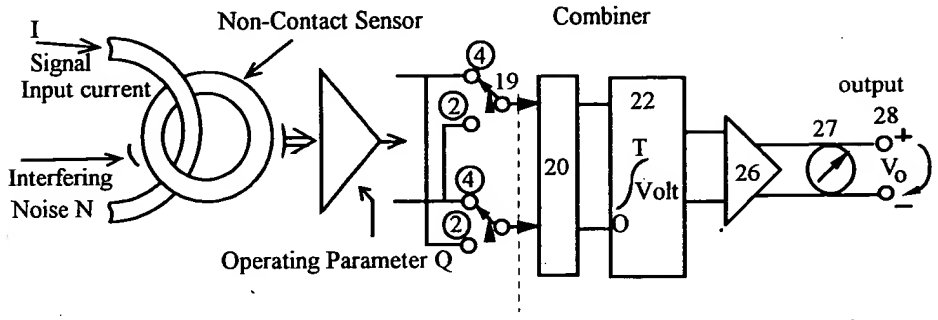
Exhibit #IV

Characteristic of Non-Contact Combiner Species Exhibit #V

Genus: Claim 30 (14.1)

Species: Combiner

Claims: 4, 5, 9, 11, 20, 21, 25, 27.



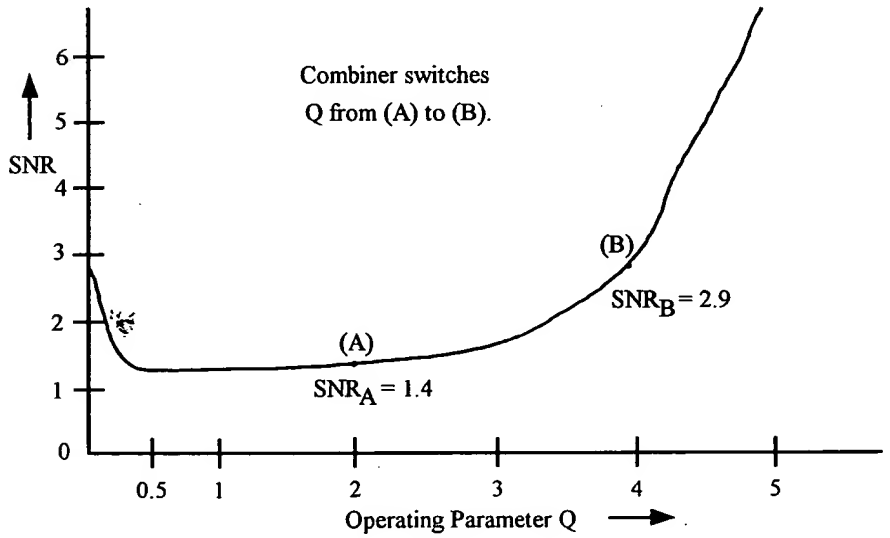
General Method.

Since it appears likely that someone will find sensors and/or implements for measurement or control of diverse physical quantities such as position or chemical concentration we need a general method and/or procedure for determining if the sensor has the essential characteristic, and if so, how to use selective modulation to improve accuracy by canceling error.

Eq. i) $V_c = (g_B - \frac{g_A}{\eta})I + (g_B\Psi_B - \frac{g_A\Psi_A}{\eta})N$

This is a more basic equation, i.e., a general method. The second term is the error due to noise which we want to cancel. Then the coefficient of noise N will be zero if:

$$g_B\Psi_B = \frac{g_A\Psi_A}{\eta}.$$

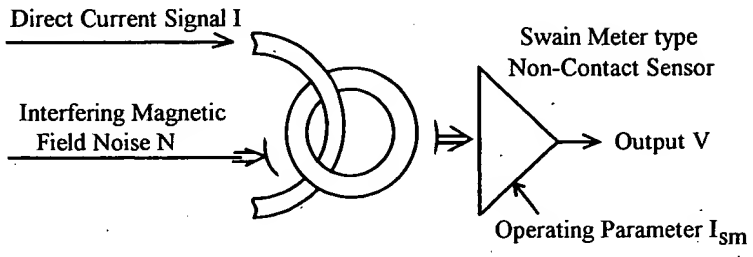


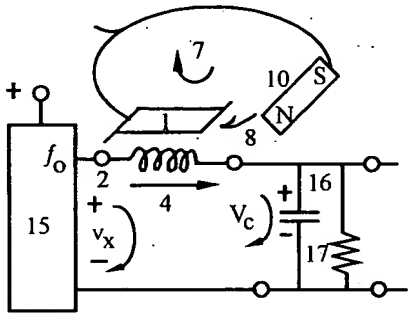
Signal to Noise Ratio (SNR) vs. Operating Parameter Q

V

Characteristic of a Sensor of the Swain Genus: Claim 31 (14.2) Exhibit #VII

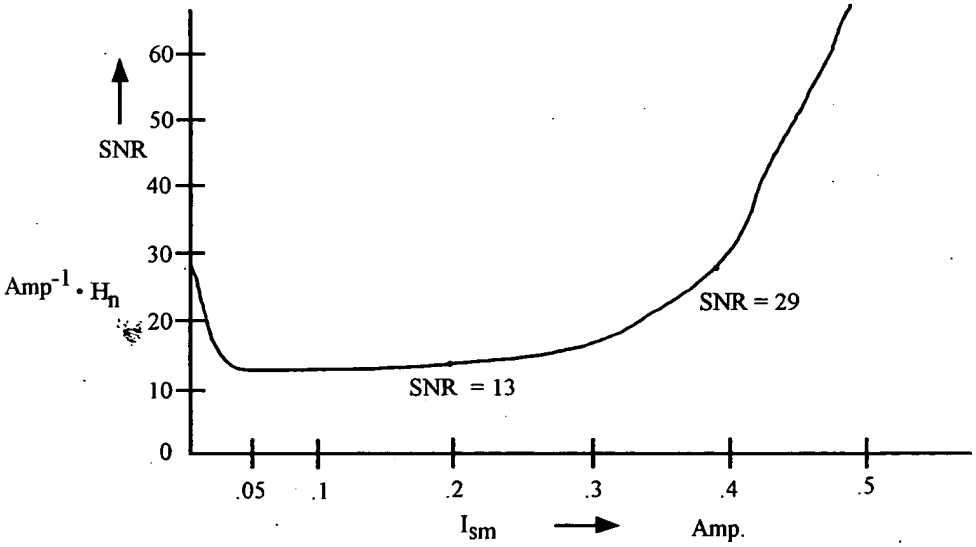
Representation of Generic Sensor Claim 31 (14.2)





DISCOVERY

The inventor discovered that the output V of many Swain Meter clamps was a lot less sensitive (1/2 to 1/3 in some sensors) to a change in the intensity of a non-uniform magnetic field H_n when the magnitude of an operating parameter I_{sm} was doubled or tripled. And the sensitivity (gain) to a change in signal input current I stayed constant to within a few percent.



Signal to Noise Ratio (SNR) for Non-Uniform Field H_n vs. Operating Parameter I_{sm}

VII

Characteristics of MEC type DC Amp Clip (photo 2) Exhibit #VIII

Genus: Claim 31 (14.2)

Species: Combiner

Claims: 6, 7, 22, 23

Swain type Clamp-on Ammeter

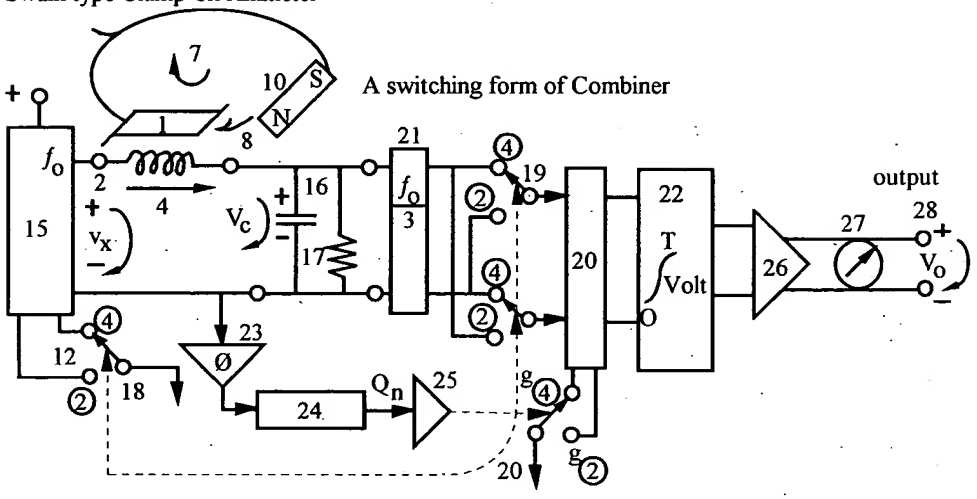
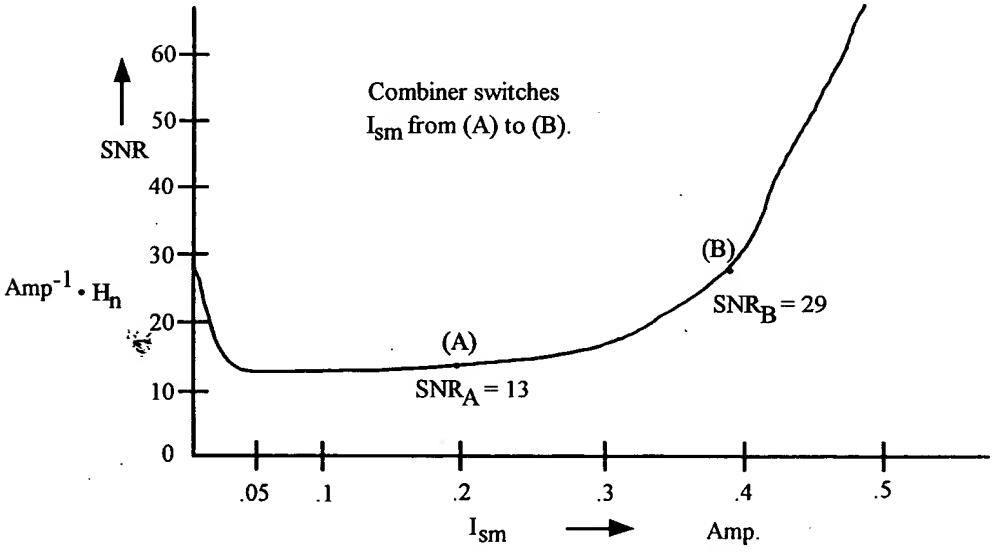


Fig. 9: A switching implementation of the mathematical relationship shown in Eq. i).

$$\text{Eq. i)}\quad V_c = (g_4 - \frac{g_2}{\eta})I + (g_4\Psi_4 - \frac{g_2\Psi_2}{\eta})N, \text{ where}$$

V_c is the specific sensor output with error corrected.

Eq. i) shows how noise is canceled. The noise term (2 d term) balances all the noise at point B at I_{sm} level .4 against $1/\eta$ times that at point A at I_{sm} level .2. When the two parts of the noise term are equal, the noise cancels. Final adjustment is usually done experimentally.



Signal to Noise Ratio (SNR) for Non-Uniform Field H_n vs. Operating Parameter I_{sm}

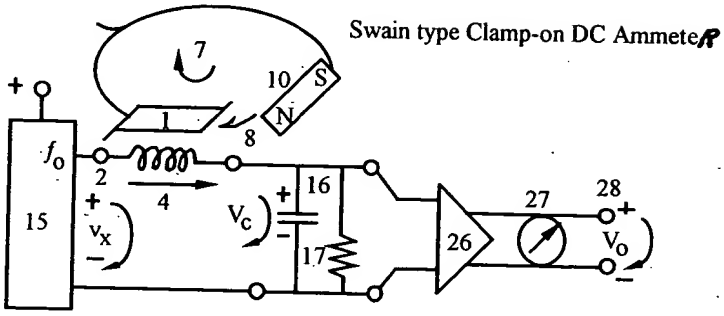
Exhibit #VIII

Characteristics of MER type DC Amp Clip Exhibit #IX

Genus: Claim 31 (14.2)

Species: Better SNR

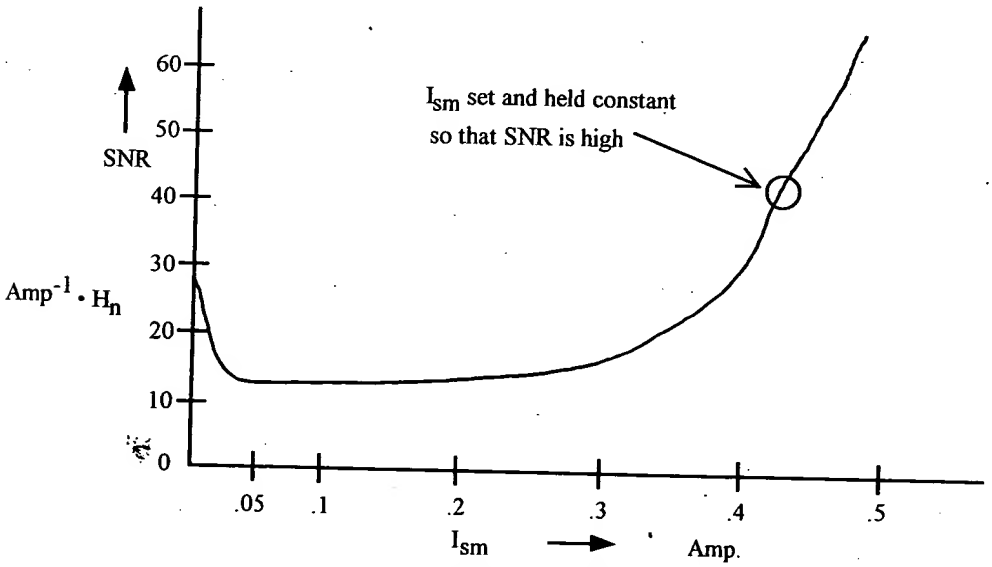
Claims: 12, 13, 28, 29



In a simpler form, SNR is substantially improved by operating at a more favorable I_{sm} operating parameter magnitude. Noise is not canceled, but this form can be faster and cost less.

DISCOVERY

The inventor discovered that the output V of many Swain Meter clamps was a lot less sensitive (1/2 to 1/3 in some sensors) to a change in the intensity of a non-uniform magnetic field H_n when the magnitude of an operating parameter I_{sm} was doubled or tripled. And the sensitivity (gain) to a change in signal input current I stayed constant to within a few percent.



Signal to Noise Ratio (SNR) for Non-Uniform Field H_n
vs.
Operating Parameter I_{sm}

IX.

3.2 Generic Claims

Applicant's invention is united in one broad Claim 14, generic to all other claims. It is shown in Exhibit I. It is discussed more fully in paragraph 7.1. Tables 7.1 through 9.2 in columns (a), (b), and (c) display some of the elements in Claim 14 together with some of the same or equivalent elements in all other prior claims.

The two new Claims, 30 and 31, are contingency claims, presented to provide for the survival of both Species "Combiner' and "Better SNR", together with some of the more narrow claims in these species.

These new Generic Claims 30 and 31 are presented so that if valid prior art is finally judged to anticipate Generic Claim 14, then more narrow generic Claim 30 will be upheld. But if even Claim 30 is anticipated, surely generic Claim 31 (14.2) will survive to support:

Species Combiner Claims 6, 7, 22, and 23, plus
Species Better SNR Claims 12, 13, 28, and 29.

Generic Claim 30 is shown in Exhibit IV. It is the first fall back position. It covers Claim 31, and all claims in Exhibit V, plus VII through IX.

Generic Claim 31 is shown in Exhibit VII. It is the second fall back position. It covers the claims in Exhibits VIII and IX.

Elements joining generic claims are discussed in paragraph 5.3 on page 33. Characteristics of the two species are also summarized in paragraphs 5.2 and 5.4.

3.3 Traverse:

In the examiner's action paragraph 3, it is stated that invention 1 is drawn to Method of Use, class 324, subclass 117H. Applicant holds that these claims and all other claims were originally drawn to Method of Construction (Process of Making (PM)); or at least so intended. I can now see that in some this is indefinite, so Claims 1, 10, 12, 26, and 28 are here presented in amended form so that PM is more definite. Reconsideration is requested.

For example, Claim 1 originally used the words "construct" in line 4, and "provide means" in line 6. For clarity line 1 is now revised to "a method for making..."

Further, claim 10 originally used "manufactured" in line 4, "manufactured" in line 16, and "constructed" in line 19. For clarity line 1 is now revised to "a method for constructing apparatus..."

In addition, Claim 26 originally used "manufacturing" in line 5, "manufacturing" in line 17, and "constructing" in line 20. Line 1 is now revised to "a process for constructing a machine..." Other revisions are included to make Claim 26 more definitely a Process of Making.

Finally, Claim 28 in line 1 reads "constructing" as before, but deletes "and using". Moreover, lines 10 and 11 are revised to read "Provide means..."

All other claims said to be Method of Use are dependent on the above cited claims, so they are likewise all now Process of Making.

There is now no basis for a 3 way (3 inventions) requirement to restrict. Reconsideration is requested.

3.4 Summary of Traverse 3.3

All claims in this application were intended to be, and now surely are:

Process of Making, or Apparatus.

There are no Method of Use claims in this application.

There is now no basis for restriction to 3 inventions. Reconsideration is requested.

3.5 The Invention is one.

This invention is united by linking Claims. Please consider MPEP 809.03 Linking Claims [R-3]. "The most common type of linking claims, which, if allowed, act to prevent restriction between inventions that can otherwise be shown to be divisible, are:

Genus Claims linking Species Claims".

3.6 Genus Claims

Applicant presents Genus Claim 14 having elements tabulated in table 7.1 (page 21 herein) in columns (a), (b), and (c) which are the same or equivalent as Claims 1 through 13 plus 15 through 29.

New and more narrow Generic Claims 30 and 31 are characterized in Exhibits IV and VII on pages 8 and 10 herein. The lower word and graph illustrations are taken directly from the description of the invention. The upper representation symbols are new; intended to show at a glance the non-contact Sensor nature of the claim. The schematic with part numbers in Exhibit VII is from the description of the invention. It is intended to convey the Swain nature of the claim.

Claims which are sufficiently narrow to fit in Genus Claim 30 are shown in Exhibit V, page 9. The numbered combiner diagram, "General Method", Eq i) and graph are all taken directly from the description.

Species "Combiner" and "Better SNR" claims which are sufficiently narrow to be covered by Genus Claim 31 are shown in Exhibits VIII and IX on pages 11 and 12.

The list of most common type of linking claims continues in MPEP 809.03. Please consider: "A Claim to the necessary process of Making a Product linking proper process and Product Claims.

3.7 "Necessary Process"

Generic Claim 14 is characterized in Exhibit I, page 5. "The Method used..." and the graph are taken from the description. These are a paraphrase of the "Essential Characteristic". This is discussed in the description of the invention: figure 4, plus page 11, together with "Discovery", and further on page 19.

Claim 14 includes element "...Essential Characteristic..." This is shown in column (a) of table 7.1, and repeated through 9.2. Essential Characteristic is an engineer's way of saying "necessary Process." For example:

Claim 1 reads: "...find or construct a sensor...which has a signal to noise ratio SNR which changes substantially when the condition of an operating parameter Q is Selectively Modulated,..."

This is equivalent to saying "find or construct a sensor...which has the Essential Characteristic".

The "...find or construct..." calls forth the necessary Process of Making. This or its' equivalent is in each of the Claims listed below:

1 through 7 (Find or construct)

8 and 9 (chosen or constructed...)

10 and 11 (chosen or manufactured)

12 (constructing...SQ...N_s...I_{sm}...adjusting said means so that...)

13 (comprising...SQ...N_s...I_{sm}...Operating Parameter...Operating Parameter Ism set to substantially greater magnitude...)

15 (Sensor...found or constructed to have the essential characteristic...)

16 (Sensor...found or constructed to have the essential characteristic...)

17 through 23 (Find/construct and provide...Sensor...SNR which changes substantially when the condition of an Operating Parameter Q is Selectively Modulated...)

24 and 25 (Sensor at least one of chosen or constructed...)

26 and 27 (Provide a Sensor...choosing or manufacturing said Sensor...essential characteristic...)

28 (Sensor...SQ...N_s...I_{sm}...constructing...N_s...I_{sm}...)

29 (Ammeter...SQ...N_s...I_{sm}...said Operating Parameter I_{sm} set to a greater magnitude...)

3.8 Essential Characteristic Link

Summarized, all Claims 1 through 13, plus 15 through 29 have the element "find or construct" or its' equivalent. So they all have the "Necessary Process". Thus they are all linked, in essence, by the Essential Characteristic.

"Essential Characteristic" is included in Exhibit II, page 6, and also in Exhibit V, page 9.

Essential Characteristic is the generalized name given the more particular DISCOVERY shown in Exhibit VII, page 10, in both words and in graphical form.

Please consider: MPEP 806.04(h) "...Restriction should not be required if the species claimed are considered clearly unpatentable over each other..."

3.9 Species "Combiner" and "Better SNR" both include "Necessary Process."

Paragraph 3.7 above has shown that all claims include the essential characteristic ("Necessary Process"). Each of these claims are either in Species "Combiner" or Species "Better SNR". Therefore neither of these species would be patentable over the other - whether or not Generic Claims 14, 30, and 31 are present and/or allowed.

Please consider MPEP 808.01(a) Species.

"...Election of Species should not be required if the species claimed are considered clearly unpatentable (obvious) over each other..."

3.10 Examiner's Species I (1), (2), (3), (4); plus
II (1), (2), (3), (4), (5), (6); plus
III (1) and (2); Joined by Essential Characteristic.

Paragraph 3.7 above has shown that the "Necessary Process" i.e., "Essential Characteristic" is in each one of Applicant's Claims. The Examiner's species contain only these claims. Therefore each Examiner's species is linked by the "Necessary Process". Here they are unpatentable over each other. Therefore they should not be restricted; whether or not Genus Claims 14, 30, and 31 are present and/or allowed.

4. Process of Use Claim absent.

There is now no Process of Use claim so no invention can be shown to be distinct by a process for use. Reconsideration is requested.

5. Process of Making and Product Made Joined by Genus Claim 14.

Applicant sees that Product invention II can not be made by another and materially different process than invention III because both are limited by the generic sensor, and also by one of the two species. Moreover, the claimed Process of Making must yield the claimed product because both are in the same genus.

MPEP 802.01 requires that Inventions II and III be patentable over each other if restriction is made. They are not. This can be seen with reference to Exhibits I thru V, plus VII through IX. Generic Sensor Claim 14 (Exhibit I) is a part of each and every Claim, 1 through 31, to one degree or another. This is summarized in the following; and detailed in tables 7.1 through 9.2.

5.1 Inventions III and II Joined.

The Examiner's Inventions II and III are presented in Summaries A, B, and C, together with my Genus, Species, and Claim numbers. Tables 7.1 through 9.2 summarize many of the joining elements in the claims.

The claims are grouped into one of two species, "Combiner", or "Better SNR", (more detail is given in Exhibits II, III, V, VIII, and IX). The Species of a claim is determined by it's use of the element word "Combiner" or a synonym; or alternatively, the element word "Better SNR" or a synonym.

Summary A of Exhibits I, II, and III.
Genus: Claim 14

	Species: Combiner	Species: Better SNR
Invention II	Claim 8	Claim 15
	16	
	24	
Invention III	Claim 17	—
	18	
	19	

The Claims of Inventions II and III in the above summary A are not Patentably distinct (not subject to restriction) because they are all joined by common Genus Claim 14. Joining claim elements are summarized in tables 8.1, 8.5, and 9.1.

5.2 "Combiner" Species

Six claims are also linked by common Species combiner. Claim elements common to the Combiner Species include, in Invention II:

Claim 8 uses "Combiner" and "largely cancel" noise N. (Table 8.1)

Claim 16 uses "Combiner" and "largely remove" noise N. (Table 8.5)

Claim 24 uses "Combiner" and "largely cancel" noise N. (Table 8.5)

Tables 8.1 and 8.5 also present claim elements joining Claims 8, 16, and 24 to Claim 14.

These same elements are contained in Invention III:

Claim 17 uses "Combiner" and "mostly cancel" noise N. (Table 9.1)

Claims 18 and 19 are dependent on Claim 17, so they also use "Combiner" and "mostly cancel" noise N. Table 9.1 also presents claim elements joining claims 17, 18, and 19 to Claim 14.

5.1A Inventions III and II Joined; Cont.

Other claims in Inventions II and III are joined by a common genus. And some are in the same species. They likewise are not patentably distinct and thus should not be restricted.

Summary B of Exhibits IV and V.

Genus: Claim 30 (14.1)

	Species: Combiner	Species: Better SNR
Invention II	Claim 9	—
Invention III	Claim 20	—
	21	

Moreover, Claims 9, 20, and 21 share a common Genus Claim 30 and thus Claim 14 and common species Combiner by inclusion in each element the words "Combine", and "largely", or "mostly cancel" noise N. Some of the generic claim elements are shown in tables 8.1 and 9.1. Therefore Claims 9, 20, and 21 lack Patentable distinction and need not be restricted.

Still more claims in Inventions II and III share a common genus and species. Please see Summary C on page 33.

Table 7.1 Claim Elements

Claim	Species	a	b	c
1.	Combiner	"...Signal to Noise ratio SNR which changes substantially when the condition of an Operating Parameter Q is Selectively Modulated..." plus "...combined..." "...Noise N mostly cancels..."		"...Sensor..." "...output V..." "...Signal input I..." "...Interfering noise N..." plus "...Implement..." "...output V_c..."
2.	Combiner	Dependent on Claim 1 so Same as Claim 1 plus "...change by only a small amount..." ...time...one full operating cycle..."		Same as Claim 1 because it depends on Claim 1
3.	Combiner	Same as Claim 1, plus "...Two sensors or a composite sensor..." "...operates full time at a... ...different...Q."		Same as Claim 1
4.	Combiner	Same as Claim 1, plus "...Hall device..."		Same as Claim 1 plus "...non-contact Ammeter..."

Table 7.1 Claim Elements (cont.)

Claim	Species	a	b	c
5.	Combiner	Same as Claim 1 plus "...Hall device... "...Operating parameter Q is Magnetic reluctance of...SQ"		Same as Claim 1 plus "...non-contact Ammeter..."
6.	Combiner	Same as Claim 1 plus "...Swain type...N_s...SQ..."		Same as Claim 1 plus "...non-contact Ammeter..."
7.	Combiner	Same as Claim 1, plus "...Swain type...N_s...SQ... ...Operating Parameter Q is the Peak current I_{sm}..."		Same as Claim 1, plus "...non-contact Ammeter..."
14.	Generic most general	"...essential characteristic... Signal to Noise Ratio SNR is substantially altered by Selective Modulation of an Operating Parameter Q;...	"... $SNR = \frac{\delta V / \delta I}{\delta V / \delta N}$ ..."	"... Sensor... output V responsive Physical quantity I,... undesired interference N,...

Table 7.2 Claim Elements

Claim	Species	a	b	c
10.	Combiner	"...essential characteristic... "...altered...(Q)... ...Substantially Modifies...SNR... ...Selective Modulation... ...Operating Parameter Q;... plus "...Combining, usually by subtracting..." "...time...essential constant... "...means which function continuously..." "...continuously available...error corrected output..."	"...$g \equiv \frac{\delta V}{\delta I}$..." "...$\Psi \equiv \frac{\delta V / \delta N}{g}$..." "...$SNR = \frac{1}{\Psi}$..."	"... Sensor... ...output V... "...Desired signal input I..." "...Intefering noise N..." plus "...apparatus..." "...error corrected output V_c ...
11.	Combiner	Same as Claim 10		Same as Claim 10, plus non-contact Current Sensor.
14.	Generic most general	"...essential characteristic... Signal to Noise Ratio SNR is substantially altered by Selective Modulation of an Operating Parameter Q;...	"... $SNR = \frac{\delta V / \delta I}{\delta V / \delta N}$ ..."	"... Sensor... output V responsive Physical quantity I,... undesired interference N,...

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Table 7.3 Claim Elements

Claim	Species	a	b	c
12.	Better SNR	Swain type elements including: "...core...SQ... ...winding...N_S ... ...inverter... ...change in said gain g is considerably less than the change in said noise sensitivity Ψ... ...operating parameter...I_{sm} ... plus ...Noise sensitivity Ψ is reduced...to...considerably less... ...accomplished by altering...N_S and...I_{sm} ... ...a greater...product...N_S and said I_{sm} ,... ...reduced error...due to said Noise N."	"...$\Psi \equiv \frac{\delta V_c / \delta N}{g}$ ... "...$g \equiv \frac{\delta V_c}{\delta I}$ ..."	"... Sensor... ...output voltage V_c ... ...signal current I... ...magnetic field noise N...
14.	Generic most general	"...essential characteristic... Signal to Noise Ratio SNR is substantially altered by Selective Modulation of an Operating Parameter Q;...	"... SNR = $\frac{\delta V / \delta I}{\delta V / \delta N}$ ..."	"... Sensor... output V responsive Physical quantity I,... undesired interference N,...

2/9/9

Table 7.4 Claim Elements

Claim	Species	a	b	c
14.	Generic most general	"...essential characteristic... Signal to Noise Ratio SNR is substantially altered by Selective Modulation of an Operating Parameter Q;...	"... SNR = $\frac{\delta V / \delta I}{\delta V / \delta N}$ ..."	"... Sensor... output V responsive Physical quantity I,... undesired interference N,...
26.	Combine.	Essential Characteristic... SNR... ...Selective Modulation.. Substantially modifies the value of said Signal to Noise ratio SNR,... Operating Parameter Q... plus "...combining...subtracting... ...Selective Modulation M...value... ...First range...second range... ...error corrected output V_c ... ...essential constant...continuously...two sensors...	$g = \frac{\delta V}{\delta I}$ $\Psi = \frac{\delta V}{\delta N}$ $SNR = \frac{1}{\Psi}$	"...Sensor... output V responsive... Physical quantity I... interfering Noise N... plus "...machine... ...output V_c ...
27.	Combine	Same as Claim 26		Same as Claim 26, plus "...non-contact Sensor..."

Table 8.1 Claim Elements

Claim	Species	a	b	c
14.	Generic most general	"...essential characteristic... Signal to Noise Ratio SNR is substantially altered by Selective Modulation of an Operating Parameter Q;...	"... $SNR = \frac{\delta V / \delta I}{\delta V / \delta N}$ ..."	"... Sensor... output V responsive Physical quantity I,... undesired interference N,...
8.	Combiner	"...essential characteristic..." "...Operating Parameter Q..." "...Selective Modulator..." "...Sensitivity of said output V to said signal I is altered substantially differently from the sensitivity of said output V to said noise N..." plus "...I and...N...Constant..." "...$T_{A\ \&\ B}$..." "...largely correct..." "...Combining..." "...Noise N is largely canceled at said inplement output V_c ...	$g = \frac{\delta V}{\delta I}$ $\Psi = \frac{\delta V / \delta N}{g}$	"... Sensor... "...output V which changes when a desired signal input called I, changes..." "...output V...has an error when an intefering noise source called N changes.. plus "...implement having an output V_c
9.	Combiner	Dependent on Claim 8, so same as claim 8.		Same as Claim 8 because it depends on Claim 8, plus "...non-contact Current Source."

Table 8.2 Claim Elements

Claim	Species	a	b	c
13.	Better SNR	...Operating Parameter I_{sm} set to a substantially greater magnitude..." "...than minimum...SNR,..." "...SNR considerably increased..." "...considerably greater accuracy..." plus "A Swain type..."		"...Non-Contact Direct Current Ammeter..." "...output voltage V..." "...signal input current I..." "..Interfering Magnetic Field Noise...N..."
14.	Generic most general	"...essential characteristic... Signal to Noise Ratio SNR is substantially altered by Selective Modulation of an Operating Parameter Q;...	"... SNR = $\frac{\delta V / \delta I}{\delta V / \delta N}$ ..."	"... Sensor... output V responsive Physical quantity I,... undesired interference N,...

Table 8.4 Claim Elements

Claim	Species	a	b	c
14.	Generic most general	"...essential characteristic... Signal to Noise Ratio SNR is substantially altered by Selective Modulation of an Operating Parameter Q;...	"... SNR = $\frac{\delta V / \delta I}{\delta V / \delta N}$ ..."	"... Sensor... output V responsive Physical quantity I,... undesired interference N,...
15.	Better SNR	Same as Claim 14 plus "...means enabling...at least one of...said "...sensor and said ...Operating Parameter Q so that said machine output V_c is more useful..." "...accuracy..."	Same as Claim 14	Same as Claim 14 plus "...machine output V_c..."

Table 8.5 Claim Elements

Claim	Species	a	b	c
14.	Generic most general	"...essential characteristic... Signal to Noise Ratio SNR is substantially altered by Selective Modulation of an Operating Parameter Q;...	"... SNR = $\frac{\delta V / \delta I}{\delta V / \delta N}$ ..."	"... Sensor... output V responsive Physical quantity I,... undesired interference N,...
16.	Combiner	Same as Claim 14, plus "...combined..." "...interference N is mostly removed from said machine output V_c..."	Same as Claim 14	Same as Claim 14, plus "...machine output V_c..."
24.	Combiner	Dependent on Claim 16, so same as Claim 16; plus "...I and...N...largely constant....T_A & B "...Q has...M_A and M_B "...N is largely canceled	$g \equiv \frac{\delta V}{\delta I}$ $\Psi \equiv \frac{\delta V / \delta N}{g}$	same as Claim 16 because dependent on Claim 16
25.	Combiner	Dependent on Claim 24, so same as Claim 24.		Same as Claim 24 because dependent on Claim 24, plus "...non-contact Current Sensor."

Table 8.6 Claim Elements

Claim	Species	a	b	c
14.	Generic most general	"...essential characteristic... Signal to Noise Ratio SNR is substantially altered by Selective Modulation of an Operating Parameter Q;...	"... $SNR = \frac{\delta V / \delta I}{\delta V / \delta N}$ ..."	"... Sensor... output V responsive Physical quantity I,... undesired interference N,...
29.	Better SNR	"Operating Parameter I_{sm} set to a greater magnitude...so that thereby SNR is considerably increased..." "... I_{sm} which is an Operating Parameter Q..." plus "A Swain type..."		"... Sensor ... output...V... Signal input current I... Interfering Magnetic field noise...N... plus "...non-contact direct current ammeter..."

Table 9.1 Claim Elements

Claim	Species	a	b	c
14.	Generic most general	"...essential characteristic... Signal to Noise Ratio SNR is substantially altered by Selective Modulation of an Operating Parameter Q;...	"... SNR = $\frac{\delta V / \delta I}{\delta V / \delta N}$ ..."	"... Sensor... output V responsive Physical quantity I,... undesired interference N,...
17.	Combiner	"... Signal to Noise Ratio SNR which changes substantially when the condition of an Operating Parameter Q is Selectively Modulated,... plus "...Combined..." "...Error due to said Noise N mostly cancels.."		"... Sensor... output V... Physical Quantity I Interfering Noise N plus "...machine..." "...output V_c..."
18.	Combiner	Dependent on Claim 17, so same as Claim 17, plus "...during...one full operating cycle..." "...I and...N...changed by only a small amount..."		Same as Claim 17 because Claim 18 depends on Claim 17.
19	Combiner	Same as Claim 17 plus "...each one..." "...Operates full time at a different..." "...Operating Parameter Q."		Same as Claim 17, plus "...Two said sensors..." "...Composite sensor..."

Table 9.1 Claim Elements (cont.)

Claim	Species	a	b	c
20.	Combiner	Same as Claim 17, plus "...hall device..."		Same as Claim 17, plus non-contact Ammeter
21.	Combiner	Same as Claim 17, plus "...Hall device..." "Q is Magnetic reluctance..."		same as Claim 17, plus non-contact Ammeter
22.	Combiner	Same as Claim 17, plus "...Swain type..."		Same as Claim 17, plus "...non-contact Ammeter..."
23.	Combiner	Same as Claim 17, plus "...Swain type..." "...Q is at least one of the Peak current I_{sm}, or the number of turns...N_s."		Same as Claim 17, plus "...non-contact Ammeter..."

Table 9.2 Claim Elements

Claim	Species	a	b	c
14.	Generic most general	"...essential characteristic... Signal to Noise Ratio SNR is substantially altered by Selective Modulation of an Operating Parameter Q;...	"... SNR = $\frac{\delta V / \delta I}{\delta V / \delta N}$ ..."	"... Sensor... output V responsive Physical quantity I,... undesired interference N,...
28.	Better SNR	"...operating parameter.. I_{sm}... Change in said gain g is considerably less than the change in said noise Sensitivity Ψ... Plus Ψ is reduced from a maximum to a value Considerably less... by altering...N_S or...I_{sm}... Preferably to a greater value,..." thereby...reduced error...due to said noise N." plus Swain type elements: "...core...SQ... ...winding...N_S... ...Inverter... ...greater...product of said N_S and said I_{sm}..." ...reduced error in Zero offset..."	$\Psi = \frac{\delta V_c / \delta N}{g}$ $g \equiv \frac{\delta V_c}{\delta I}$	"...Sensor... output voltage V_c ... Signal Current I... Magnetic field noise...N...

Summary C of Exhibits VII, VIII, and IX.

Genus: Claim 31 (14.2)

	Species: Combiner	Species: Better SNR
Invention II	—	Claim 13 Claim 29
Invention III	Claim 22 Claim 23	Claim 28

Therefore these are like those in summaries A and B above in that they are all in the same genus, so are not patentably distinct and therefore not subject to division or restriction.

The Claims in Summary C are joined by a common Genus Claim 31 (14.2). As with all Generic Sensors, this one has a SNR which changes when an operating parameter changes: in this case I_{sm} in a Swain Sensor. Therefore these Inventions in Summary C also lack patentable novelty over one another and need not be divided.

5.3 Generic Claims

Genus Claim 14 (Exhibit I) is the broadest, or most general. Claims 30 and 31 are generic, but less general, so apply to fewer Species Claims. For example:

Claim 14 encloses Genus Claim 30 (14.1) (Exhibit IV) which is a more limited version, requiring a non-contact current sensor. Genus Claim 30 (14.1) encloses Genus Claim 31 (14.2) (Exhibit VII) which is a more limited version, requiring a Swain type non-contact direct current sensor. Claim 31 is also enclosed by Claim 14.

Generic Claims are also discussed in paragraph 3.2 on page 13. Shared Generic Claim elements are tabulated in tables 7.1 through 9.2

5.4 "Better SNR" Species

Species "Better SNR" Claims in Summaries A, B, and C above contain a common element or equivalent. Detail is given here and in the tables.

Claim 13 in Summary C says: "...I_{sm} set...SNR is considerably increased..." (table 8.2)

Claim 29 says: "...I_{sm} set...SNR considerably increased..." (table 8.6)

Claim 28 says: "...Ism set...Noise Sensitivity Ψ is considerably reduced..." (As stated in the description, this means SNR is increased). (table 9.1)

Claim 15 in Summary A says: "...operating parameter Q so that machine output V_c is more useful...accuracy..." (This means, among other things, better SNR.) (table 8.4)

5.5 Summary of Traverse 5:

Inventions II and III lack patentable distinction over each other because:

a) they are both in Genus Claim 14, and

b) they are both in either Species "Combiner' or Species "Better SNR".

Therefore division is not required. Reconsideration is requested.

6. One Invention

Applicant believes that the preceding discussion established the unity of the invention. It consists of one Invention with one generic claim (the more broad of those finally surviving examination); two species; and 29 claims plus 2 narrower genus claims for backup.

Reconsideration of the requirement to restrict is requested.

Paragraph VII Traverse Introduction

Examiner's paragraph numbers are used in Applicant's response. For example, subject matter introduced by Examiner in his paragraph 8, Species 2 elicits Applicant's response and traverse in Applicant's paragraph Species 8.2. Reference is made to table 8.2. This tabulates some elements of the claims specified in Examiner's paragraph 8, Species 2.

For convenience, Examiner's Inventions and all of Applicant's Claims are listed with Species and Genus in single page table I, page 2.

Eight Exhibits (I through IX, less VI) are presented as pages 5 through 12 to facilitate sorting and grouping all claims by Genus and Species. Illustrations are given to show characteristics and relationships at a glance.

A traverse summary may be followed by a more detailed traverse. The summary will usually reference a table. Thus my traverse of Examiner's paragraph 9, Invention II, Species (1) will be marked Species 9.1, and reference table 9.1.

Tables 7.1 thru 9.2 (pages 20 to 32 herewith) display Applicant's species for each claim. Claim elements which particularly specify species generally follow the word "plus" in column (a) and/or column (c).

The description of the invention gives the meaning of Claim elements. References to Elements in generic Claim 14, and thus all claims, are given in paragraph 7.1 through 9.2. These show that at least two elements in every claim are anticipated by generic Claim 14.

Some claims are broader than others. If a broad claim is finally judged to have been anticipated by another inventor, then it is hoped that the greater detail given in the more narrow claims will still be found novel. Or it may be that the wording of one claim is better than another.

7. Summary of Traverse of Examiner's Invention 1, Species 7.1, 7.2, 7.3, and 7.4.

It is shown in the claims, and in sections 3.1 and 4 of this response that Invention I is now entirely Process of Making. I expect the next step is to show that they are all in Genus Claim 14; or in more narrow Genus Claim 30 (14.1); or in Genus Claim 31 (14.2) which is still more narrow. These are discussed in sections 3.2 and 7.1.

7.1 Elements in Generic Claim 14

Applicant puts forth Claim 14 as generic to all other claims (claims 1-13, plus Claims 15-31). This is justified with the aid of table 7.1 through 9.2. These show that Generic Claim 14 has at least 3 types of elements, shown in columns a, b, and c; and that all other claims share some of these elements.

Element types in claim 14 include:
"essential characteristic". This is defined and explained in the description of the invention, pages 5, 6, 11, 13, 19, 23, 57, 58, 61, plus figures 4, 5, and 8;

"Signal to Noise Ratio SNR" is another element. Magnetic Field H_S, and H_n, and noise N are involved. Description is given on pages 5, 9, 11, 12, 14, 15, 19, 20, 24, and figure 4 of the invention.

"Selective Modulation" is shown on pages 4, 5, 11, and 23;

"Operating Parameter Q". This and I_{sm} appear on pages 4, 11, 12, 13, 20, 21, 24, and figure 4.

7.2 Characteristic of Generic Sensor Claim 30 (14.1)

Operating Parameter Q can be thought of as an input to a modulator, or as the modulator itself. Functionally, a change in Q causes a change in the SNR of the sensor.

Species 7.1

Table 7.1, page 21 shows some of the claim elements of Generic Claim 14. The same or equivalent elements in independent Claim 1 appear on page 20. For example: In column (a) both have SNR which changes a lot when Q is changed. In column (c) both have a sensor with an output responsive to desired input I and undesired input N.

Claim 1 contains limitations of Claim 14, so they are not patentably distinct from one another. Dependent Claims 2 through 7 have the limitations of Claim 1.

Species 7.2

Table 7.2 (page 22) tabulates some elements of Claim 14 with elements of Claim 10. In column (a) the SNR changes a lot when Q changes. The "change" phrases are another way of stating the "Discovery" or "Essential characteristic". Also, in column (c) Claims 14 and 10 both have sensor, output voltage, and signal plus noise inputs I and N.

Thus Claim 10 contains limitations of Claim 14, so they are not patentably distinct from one another.

Claim 11 in table 7.2 depends on Claim 10, so Claim 11 also contains limitations of Claim 14, so they are not patentably distinct from one another.

Thus Claim 14 is generic to the claims in Examiner's Invention I, Species 7.1, and 7.2. Tables 7.1 and 7.2 show these as Applicant's Combiner Species.

Species 7.3

Table 7.3 (page 23) tabulates some elements of Claim 14 with elements of Claim 12. In column (a) the noise Ψ changes when I_{sm} changes. The description shows that SNR = $1/\Psi$. It also shows that the "change" phrases are another way of stating the "Discovery" or "Essential characteristic". Also, in column (c) Claims 14 and 12 both have sensor, output voltage, and desired and undesired inputs I and N.

Thus Claim 12 contains limitations of Claim 14, so they are not patentably distinct from one another.

Thus Claim 14 is generic to the claims in Examiner's Invention I, Species 7.3. Table 7.3 shows Claim 12 in Applicant's Better SNR Species.

Species 7.4

Table 7.4 (page 24) tabulates some of the claim elements of Generic Claim 14 together with some of those of independent Claim 26. In column (a) both have SNR which changes a lot when Q is changed. In column (c) both have a sensor with an output responsive to desired input I and undesired input N.

Claim 26 contains limitations of Claim 14, so they are not patentably distinct from one another. Dependent Claim 27 has the limitations of Claim 26 also.

8. Traverse of the Examiner's requirement to restrict the Examiner's Invention II- Apparatus. Species 8.1

Table 8.1 on page 25 tabulates some of the claim elements of Generic Claim 14 together with some of those of independent Claim 8. In column (a) both have SNR (or equivalent noise sensitivity) which changes a lot when Q is changed. In column (c) both have a sensor with an output responsive to desired input I and undesired input N.

Claim 8 contains limitations of Claim 14, so they are not patentably distinct from one another. Dependent Claim 9 has the limitations of Claim 8.

Claims 8 and 9 lack patentable novelty over Claim 14 (see table 8.1, page 25) because all three include the elements:

Sensor

output V

Signal Input I

Interfering noise source N

Essential Characteristic

Operating Parameter Q

Selective Modulator

Sensitivity of said output V to said Signal I is altered substantially differently from the sensitivity of said output V to said noise N. (As noted in the description, this says, in effect, the SNR changes a lot when Q changes).

Species element "Combining" (means are provided for C...) is also contained in Claims 8 and 9.

"Combining" involves "subtract", "null out" or "cancel noise". Combining is very different from such Species "Better SNR" phrases as "noise substantially reduced by a factor of 2 or 3 to one", "SNR considerably improved," etc.

Claims 8 and 9 are more specifically generalized forms of embodiments of the invention given in the description figures 9, 10, and 11 and the associated discussion. Changes occurring during time

segments Ⓐ and Ⓑ are presented. The implement of Claims 8 and 9 contains means modulating Q (M_A and M_B). Reasonable magnitudes for gain (g_A and g_B) and noise sensitivity (ΨA and ΨB) are given in terms of ratios ß, G, and η. This timed implement is more limited than some claims. However, Applicant sees it as a more narrow claim in the species "Combiner"; not a new species.

Claim 9 is still further limited to a non-contact sensor. Thus it can be grouped in Exhibit V under generic Claim 30 (14.1).

Species 8.2

Table 8.2 tabulates some elements of Claim 14 with elements of Claim 13. In column (a) the SNR changes when I_{sm} changes. The "considerably increased, - greater" phrases are another way of stating the "Discovery" or "Essential characteristic". Also, in column (c) Claims 14 and 13 both have sensor or equivalent Ammeter, output voltage, and signal plus noise inputs I and N.

Thus Claim 13 contains limitations of Claim 14, so they are not patentably distinct from one another.

Thus Claim 14 is generic to the claims in Examiner's Invention II, Species 8.1, and 8.2. Table 8.1 shows Claims 8 and 9 as Applicant's Combiner Species. Table 8.2 shows Claim 13 as Applicant's Better SNR Species.

Claim 13 is shown in Exhibit IX as being grouped under generic Claim 31 (14.2); and in Species "Better SNR". Here the genus is Claim 31 (14.2) shown in Exhibit VII.

The elements in generic Claim 31 are simply more particular (Swain Meter) forms of the more broadly defined elements in generic Claim 14. The same key concepts are presented in both. These include:

Claim 14 references elements:

"Essential Characteristic",

"Signal to noise Ratio SNR is substantially altered by ... operating parameter Q".

New more narrow generic Claim 31 states these elements in terms of a Swain Meter:

"Discovery"

"... output a lot less sensitive to...

magnetic field (noise, in description)...

when operating parameter I_{sm} was doubled...".

SNR doubled when I_{sm} is doubled is shown on the graph of Exhibit VII.

Claim 13 is shown in Exhibit IX as being in Species "Better SNR". An element is the generic claim - the graph of SNR vs. I_{sm} - is still more limited in that I_{sm} is set at a level for high SNR.

Applicant sees a different claim, not a new Species over the more broad Species "Better SNR" Claim 15 in Exhibit III.

Claim 13 is in a different Species than Claim 8, because Claim 8 is Species "Combiner".

Species 8.3(A) Linking Claims - Genus

MPEP 809.03 Linking Claims [R3] refers to "...genus claims linking species...". Claim 14 is this. Table 8.2, page 26 herein lists six claim elements stated in Claim 14. These are defined in the description of the invention. A list is given in this response, section 7.1 page 36.

Exhibit I on page 5 characterizes the Generic Sensor, Claim 14. "The method used..." is directly from the description, as is the graph. This is a paraphrase of the "Essential Characteristic", which is a generalization of the particular measurements given in the "Discovery" stated in Exhibit VII, page 10, itself a repeat of the description.

New Linking Claim 30 (Exhibit IV, page 8) is more narrow (a non-contact sensor), but broad enough to link all claims in Exhibits V, VII, VIII, and IX (page 12).

New Linking Claim 31 (Exhibit VII, page 10) is still more narrow (a non-contact Swain type sensor), but broad enough to link the Claims in Exhibit VIII and IX (page 12).

Species 8.3(B) Linking Claims - "...Necessary Process..."

MPEP 809.03 Linking Claims [R3] continues to "...A claim to the necessary process of making a Product Linking Proper Process and Product Claims..."

"Essential Characteristic" is something each apparatus or Process of Making in Applicant's one invention has got to have. "...Find or construct...", "...chosen or manufactured...", or equivalent are included in each of Claims 1 through 31. (paragraph 3.7, page 16).

Thus the provision for the "Essential Characteristic" is a "Necessary Process" linking every claim - Species "Combiner"; Species "Better SNR"; and Generic.

Claims 1 through 13 and 15 through 29 are linked by "Necessary Process", even without a generic claim.

One of several definitions of the "Essential Characteristic" is given in "Outline of Contents" on page 5 of the description of the invention. For convenience, this is quoted below.

"The Discovery that many Swain sensors had a zero offset Z error heavily dependent on the magnitude of operating parameter I_{sm}, but stable gain g for the input signal I, is shown in Fig. 4. Normalized output error Ó and noise sensitivity Ψ are introduced, along with signal to noise ration SNR. This is plotted in Fig. 5. Both Fig. 4 and Fig. 5 illustrate the Essential Characteristic needed in a sensor for successful noise correction by selective modulation. We have also seen these in a Hall type clamp-on DC ammeter."

Species 8.4

Table 8.4 tabulates some of the claim elements of Generic Claim 14 together with some of those of independent Claim 15. In column (a) both have SNR (or equivalent noise sensitivity) which changes a lot when Q is changed. In column (c) both have a sensor with an output responsive to desired input I and undesired input N.

Claim 15 contains limitations of Claim 14, so it is not patentably distinct from Claim 14.

Species 8.5

Table 8.5 tabulates some elements of Claim 14 with elements of Claim 16. In column (a) both have SNR which changes a lot when Q changes. Also, in column (c) Claims 14 and 16 both have sensor, output voltage, and signal plus noise inputs I and N.

Thus Claim 16 contains limitations of Claim 14, so they are not patentably distinct from one another.

Table 8.5 also tabulates some elements of dependent Claims 24 and 25, also arranged with similar elements in Generic Claim 14, as well as Claim 16. Since Claims 24 and 25 depend on Claim 16, these Claims likewise contain limitations of Claim 14, so they are not patentably distinct from one another.

Species 8.6

Table 8.6 tabulates some of the claim elements of Generic Claim 14 together with some of those of independent Claim 29. In column (a) both have SNR which changes a lot when Q is changed. In column (c) both have a sensor with an output responsive to desired input I and Noise input N.

Claim 29 contains limitations of Claim 14, so it is not patentably distinct from Claim 14.

Thus Claim 14 is generic to the claims in Examiner's Invention II, Species 8.4, 8.5, and 8.6. Tables 8.4, 8.5, and 8.6 show Claims 16, 24, and 25 as Applicant's Combiner Species. Claims 15 and 29 are Applicant's Better SNR Species.

8.7. Summary of Traverse of the Examiner's requirement to restrict the Examiner's Invention II-Apparatus.

All claims in Examiner's Invention II contain limitations of Generic Claim 14, and/or one of it's subs - Claim 30 or Claim 31. Therefore there is no need to divide the invention.

Claims 8, 9, 16, 24, and 25 in Examiner's Invention II are linked by being in the same Species "Combiner".

Claims 13, 15, and 29 in Examiner's Invention II are linked by being in the same Species "Better SNR".

All of these, plus Claim 14 are linked by the same "Necessary Process" which is "...found or constructed to have the Essential Characteristic..." or equivalent.

8.8 History

Historically I first "invented" i.e., made the DISCOVERY shown in the description of the Application, page 11 and copied in Exhibit VII, page 10 herewith. This led to the basic concept, which is stated in claim 14. At root; a Sensor has a Signal to Noise Ratio SNR which is substantially changed by modulating an Operating Parameter Q; and the Sensor is used to better measure or control, on it's own or as part of a Machine.

Error due to zero offset caused by a nearby magnet had long been a problem. The DISCOVERY was applied in various ways to improve the standard DC Amp Clip. It seemed that the best solution would be the Combiner approach, i.e., to null (cancel) it out using a combiner. The result is generalized in new claim 16, and shown in Exhibit II, page 6.

The "Combiner" was more complicated to build and more limited in application, so I looked for a simpler and more widely applicable cure for error due to zero offset caused by a nearby magnet. The result is the "Better SNR". Error is reduced by a factor of 2 or 3 because SNR is made better when the Sensor is suitably constructed and Operating Parameter Q is properly set. An example is shown below, (Fig. 5, page 58.)

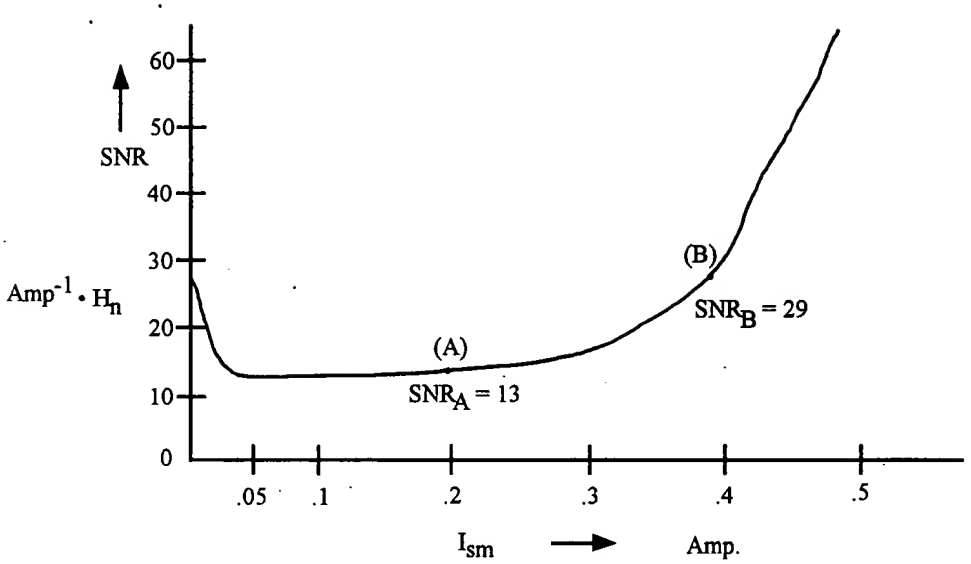

Figure 5
Signal to Noise Ratio (SNR) for Non-Uniform Field H_n vs. Operating Parameter I_{sm} for 5" dia. aperture clip #88 in SN 2336

8.9 Disclaimer

I "invented" - made the DISCOVERY (Generic Claim 14) first. Then I invented the Species "Combiner" (claim 16). Later, I realized that the simpler Species "Better SNR" (claim 15) would be a useful improvement, and simpler. So it appears that given the Genus claim 14 together with the Species "combiner", the Species "Better SNR" may be anticipated, i.e., the Species "Better SNR" perhaps is not novel over the Species "Combiner".

However, the reverse is not true. Given the Generic Claim 14 together with the Species "Better SNR", one normally skilled in the art does not have the Species "Combiner". "Combiner" is novel over "Better SNR", and also over Generic Claim 14.

In addition, given the Generic Claim 14, the application of either Species "Combiner" or Species "Better SNR" to a DC Amp Clip type Swain Meter, or to a Hall device is not obvious.

9. Traverse of the Examiner's requirement to restrict the Examiner's Invention III - A Process of Making.

Species 9.1

Table 9.1 tabulates some of the claim elements of Generic Claim 14 together with some of those of independent Claim 17. In column (a) both have SNR which changes a lot when Q is changed.

In column (c) both have a sensor with an output responsive to desired input I and undesired input N.

Claim 17 contains limitations of Claim 14, so they are not patentably distinct from one another. Dependent Claims 18 through 23 have the limitations of Claim 17.

Species 9.2

Table 9.2 tabulates some elements of Claim 14 with elements of Claim 28. In column (a) the noise Ψ changes when I_{sm} changes. The description shows that SNR = $1/\Psi$. It also shows that the "change" phrases are another way of stating the "Discovery" or "Essential characteristic". Also, in column (c), Claims 14 and 28 both have sensor, output voltage, and desired and undesired inputs I and N.

Thus Claim 28 contains limitations of Claim 14, so they are not patentably distinct from one another.

Thus Claim 14 is generic to the claims in Examiner's Invention III, Species 9.1, and 9.2. Tables 9.1 and 9.2 show all these as Applicant's Combiner Species, except Claim 28 which is Applicant's Better SNR Species.

9.3 Generic Claim

Applicant's Claim 14 is shown generic for the claims in Examiner's Invention III in tables 9.1 and 9.2 and the discussion in Applicant's paragraphs 9.1 and 9.2.

Table I on page 2 shows claims 20 and 21 in Genus Claim 14.1, i.e., Claim 30. This is due to the limitations in Claim 20 and 21, which make the full width of Genetic Claim 14 unnecessary. More narrow Claim 30 is broad enough. Exhibits IV and V on pages 8 and 9 summarize this.

Table I on page 2 shows Claims 22, 23, and 28 in Genus 14.2, i.e., Claim 31 for a similar reason. These claims are still more narrow, so Claim 31 is generic enough. Of course, Claim 14 is a fine generic claim for Claims 22, 23, and 28, but it's full breadth is not needed. Exhibits VII and VIII summarize this.

9.4 Species of Applicant's Claims

Combiner

Table 9.1 in column (a) shows that independent Claim 17 is in Species Combiner. Since Claims 18 through 23 depend on Claim 17, they are also Species Combiner.

Generally, the elements listed in column (a) after the word "Plus" are keys to species. The description of the invention shows that "Noise N mostly cancels..." solidly identifies this claim as in Combiner Species. Exhibits II, V, and VIII on pages 6, 9, and 10 illustrate this.

Similar species claim elements are shown in Column (a) of tables 7.1, 7.2, 7.4, 8.1, 8.5, and 9.1. The elements "...combined...", "...combining...", "...subtracting..." are especially clear.

Better SNR

Species Better SNR is distinct from Combiner in that the claim elements for Better SNR do NOT include "...Combiner...", "..Noise mostly cancels...", etc. In contrast, Better SNR claim elements shown in column (a) of table 9.2 include, after "plus":

"...greater...Product of said N_S and said I_{sm}..."

"...reduced error on zero offset.

The description of the invention and Exhibits III and IX on pages 7 and 12 illustrate this.

Moreover, table 7.3 shows similar claim elements in Claim 12. "...reduced error due to said noise N..." points at Better SNR Species. Similar elements are seen in Claim 13, table 8.2.

Table 8.4 shows Claim 15 in Species Better SNR by elements including: "...means enabling...at least one of...said sensor and said...operating parameter Q so that said machine output V_c is more useful...accuracy...". The description relates this accuracy and utility to better SNR & reduced Ψ.

Table 8.6 shows Claim 29 with elements "operating parameter I_{sm} set to a greater magnitude... so that thereby SNR is considerably increased..." Better SNR is apparent.

9.5 The distinction between Species Combiner and Species Better SNR is set forth in paragraph 9.4. However, use of one as basis of rejection or another is traversed in paragraph 8.7 "History" plus paragraph 8.8 "Disclaimer".

10. Applicant did not receive the Examiner's telephone call of 12 Jan 98. The Examiner may wish to leave a message on business line 941-957-3110 or home line 941-349-4593. These message services have worked well for some time.

11. Applicant has been diligent and worked hard to respond timely and fully. It is hoped that the Examiner will find sufficient grounds for reconsideration and inclusion of Generic Claim 14 plus Claims 1 through 13 and Claims 15 through 29, allocated to either Species Combiner or Species Better SNR. Sub generic new Claims 30 and 31 are also considered necessary.

W. H. Swain
Inventor
13 Feb. 98